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Enclosed is a brief discussion of the reasons that we think the log periodic antenna is more useful than the Rams Horn on System VII. I hope that this is sufficient information to answer your needs. If there are any further questions please contact us.

Very truly yours,

STATINTL [redacted]

Assistant Department Head
Operations Department

RLR:bb

Encl.

LOG PERIODIC FOR SYSTEM VII

The existing antenna for system VII is the Rams Horn. Past experience has shown that these antennas have some undesirable characteristics when used in the low VHF band (50 to 100 mc). Under laboratory conditions the Rams Horn exhibits gains of 0 db over an isotropic source. However, the antenna is electrically short at these frequencies and has a low front-to-back ratio. This allows the antenna to "see" the aircraft behind it and to act as a transducer that excites the aircraft skin. The excitation of the aircraft causes pattern break-up, lobing, and gives large impedance variations with frequency. The unpredictable pattern break-up makes it difficult to obtain the antenna's 0 db gain in actual operation. Flight tests of System VII have shown that the signal may sometimes be obtained at higher power levels off the back of the antennas. It is also very difficult to match the impedance of the antenna at any frequency since the impedance is unknown and actual impedance measurement on the aircraft is not too practical.

The above antenna characteristics may be acceptable for making radar intercepts. However, the antenna may seriously jeopardize the capability of an intercept system for making intercepts of low powered telemetry transmitters at extreme ranges. It is even more serious when the intercepts of great interest take place at the time of burnout of first stages, stage separation, re-entry of nosecones etc. The effectiveness of low powered transmitters on board the missile is further reduced at these times by plasma layers, ionization of the surrounding atmosphere, and disorientation of transmitting antennas. Adding to the problems of making these intercepts are the facts that the

intercept is usually made at extreme ranges and from poor positions. Intercepts have been made with the Rams Horn antennas where the signal to noise ratio was so low that no useful information could be extracted. It is under these conditions that an antenna with gain and good pattern stability on the aircraft will obtain usable and possibly vital information.

An excellent choice for an intercept system antenna is the log periodic. A scale model has been constructed by HRB-Singer for the Douglas A3D aircraft. This antenna has 7 db gain over an isotropic source. It exhibits a good front-to-back ratio and good pattern stability over a very broad frequency band (60-300 mc). The high front-to-back ratio minimizes the effect of the aircraft behind the antenna. It also presents a VSWR across the band of less than 1.75 to 1. Other antennas give more gain than the log periodic. However, gain cannot be increased without an associated increase in directivity. Too much directivity is not usable because of serious orientation problems. The log periodic with its 7 db gain has a pattern that is about 70° wide at the 3 db down points. This seems to be a reasonable compromise between gain and directivity. Also, any higher gain antenna such as the yagi would be just as large as the log periodic and be seriously limited in bandwidth, (about 10%). It seems appropriate at this time to consider future intercept systems before spending money for antenna development. From this standpoint the log periodic antenna, with its relatively high gain, very broad bandwidth (may be extended to a decade), good pattern predictability on the aircraft, and flat impedance characteristic across the band, is a very logical choice.